EMS Annual Meeting Abstracts
Vol. 10, EMS2013-438, 2013
13th EMS / 11th ECAM

Ensemble postprocessing for probabilistic quantitative precipitation forecasts

S. Bentzien and P. Friederichs
University of Bonn, Meteorological Institute, Germany (bentzien@uni-bonn.de)

Mesoscale weather ensemble prediction systems (EPS) are particularly developed to obtain probabilistic guidance for high impact weather. An EPS not only issues a deterministic future state of the atmosphere but a sample of possible future states. Ensemble postprocessing then translates such a sample of forecasts into probabilistic measures. This study focus on probabilistic quantitative precipitation forecasts in terms of quantiles. Quantiles are particular suitable to describe precipitation at various locations, since no assumption is required on the distribution of precipitation. The focus is on the prediction during high-impact events and related to the Volkswagen Stiftung funded project WEX-MOP (Mesoscale Weather Extremes - Theory, Spatial Modeling and Prediction).

Quantile forecasts are derived from the raw ensemble and via quantile regression. Neighborhood method and time-lagging are effective tools to inexpensively increase the ensemble spread, which results in more reliable forecasts especially for extreme precipitation events. Since an EPS provides a large amount of potentially informative predictors, a variable selection is required in order to obtain a stable statistical model. A Bayesian formulation of quantile regression allows for inference about the selection of predictive covariates by the use of appropriate prior distributions. Moreover, the implementation of an additional process layer for the regression parameters accounts for spatial variations of the parameters.

Bayesian quantile regression and its spatially adaptive extension is illustrated for the German-focused mesoscale weather prediction ensemble COSMO-DE-EPS, which runs operationally since December 2010 at the German Meteorological Service (DWD). Objective out-of-sample verification uses the quantile score (QS), a weighted absolute error between quantile forecasts and observations. The QS is a proper scoring function and can be decomposed into reliability, resolutions and uncertainty parts. A quantile reliability plot gives detailed insights in the predictive performance of the quantile forecasts.